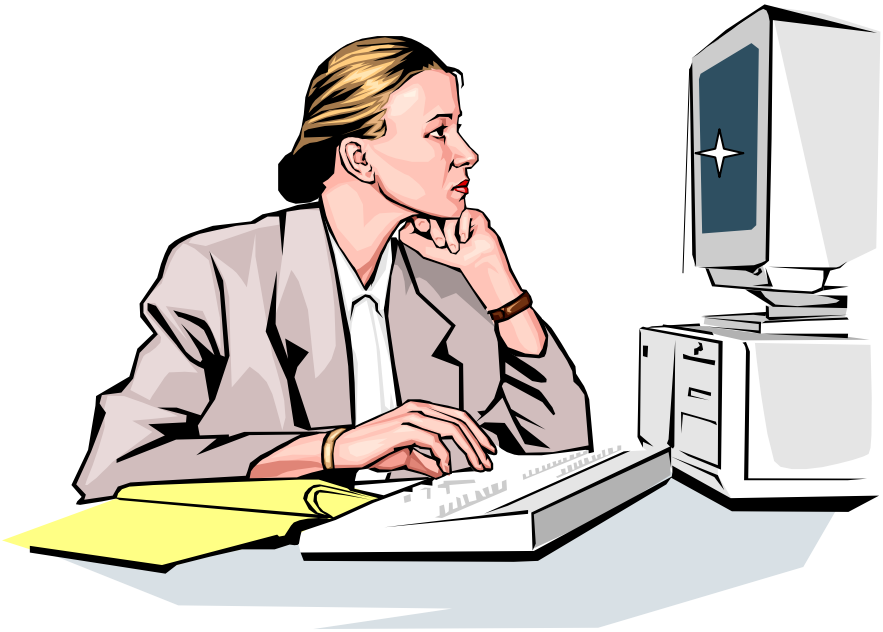
# COMPUTER ERGONOMICS



## Introduction

Ergonomics is the science of fitting the job to the worker in order to reduce injuries. Tasks that require repetitive motions, awkward positions, heavy lifting or tremendous strain can lead to repetitive strain injuries or cumulative trauma disorders (CTD). These injuries affect muscles, tendons and nerves and usually take a long time to develop. Examples of CTD include tendonitis, trigger finger and carpal tunnel syndrome. Eyestrain is a common injury associated with repetitive strain. CTD and repetitive strain injuries take a long time to develop.

Increased use of computers in the workplace has caused a corresponding rise in health concerns directly related to their use. The most common health concerns are repetitive strain injuries, general muscle strain and discomfort, and eye and vision problems. Workstation design and proper work practices can help to address these concerns.

Let's look at how to set up a workstation to minimize ill effects that might otherwise occur.

## Workstation Design

The importance of the design and layout of your workstation increases with the amount of time you spend at your computer. As a general guide, anyone who spends more than **two hours** a day in front of a Video Display Terminal (VDT) should take special care to ensure their workstation is user friendly.

Making a workstation user friendly involves more than just your chair. All elements work together to provide your working environment. If any of these elements are "out of whack" you may suffer ill effects. To maximize your wellbeing, your chair, VDT, and keyboard height should all be fully adjustable.

We'll begin by adjusting your chair to fit **you**, the operator. Once your chair has been properly adjusted it should be used as a reference point for all further adjustments.

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Anytime the chair adjustments change, the other pieces of workstation equipment probably will need to be adjusted also.

While seated at your workstation, with your feet firmly planted on the floor and the upper body in a neutral position, the monitor and keyboard positions will then be adjusted. When we say "neutral position," we mean you are neither slouched or slumped over nor rigidly at attention. Rather, you are sitting erect and alert, without straining.

Finally, additional computer accessories (such as mouse, wrist support, and copy holder) should be correctly placed.

Specific guidelines for these adjustments are outlined in the following sections.

## Chair

Computer users tend to spend most of their day seated. To provide comfortable support for each particular individual, the following features are important when selecting a chair:

- Chair height from 16 – 21 inches (42 - 54 cm) and easily adjustable.
- Seat pan:
  - Large enough to provide support for thighs and buttocks, but not pressing the back of the knees.
  - with a waterfall edge at the front to avoid pressure on underside of the lower thigh.
- Back rest provides lumbar support.
- Arm height is adjustable.
- Sturdy base with **five** legs and casters. ***Never*** use a rolling chair which as fewer than 5 legs/casters; they are easily tipped over when rolling.
- Constructed of breathable material with a dense foam that gives way no more than 1 inch (2.5 cm).

The following tips are provided to assist you in properly adjusting your chair:

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| While standing in front of your chair, adjust the height so that the highest point of the seat is just below your knee cap. |  |

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|  | Adjust the seat pan and back to that 3 fingers just fits the clearance between the front edge of the seat and the back of your knees. |
| Adjust the angle and height of the backrest of the chair so that it supports the hollow in the lower back.<br><br>Adjust the seat pan tilt to a position that is comfortable to you. |  |

A chair should be adjusted many times during the day. This will help to relieve muscle tension in specific muscle groups while loading others.

The height of most desk surfaces in GSA offices are not adjustable; therefore, adjust the chair so that your forearms are parallel to the floor, while keying. If necessary, provide a foot rest to support the legs and reduce strain on the lower back.

## Monitor

The distance from your eyes to the screen should be approximately arms length, 18 to 24 inches. Greater distances may cause you to lean forward to see the information on the screen, causing poor posture and resulting in back strain and pain.

Next, the computer screen (monitor) should be positioned so that the top line of text is at or slightly below (**never** higher than) eye level while seated as discussed in the previous section. If the monitor sets too low, you may need to place something (e.g., an old phone book) under the monitor to raise it up.

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On the other hand, eyeglasses may create problems for some computer users. Bifocal wearers may tilt their head back to view the monitor through the lower portion of their glasses. In this case, the monitor should be placed **lower** than previously recommended. To get around this problem, the use of single-focus glasses designed specifically for computer use may be the best alternative; consult your optometrist for further guidance in regards to bifocal use.

Furthermore, the monitor should be placed directly in front of the worker, not requiring the user to twist to one side or another to view or use it.

Finally, look into the screen. Can you see the ceiling lights? If so, you need to tilt the monitor so that the screen is vertical to reduce glare from those lights.

These adjustments to the monitor help keep the neck in a more neutral position, minimize muscle fatigue, and reduce glare.

## Keyboard

Your computer workstation should provide for the keyboard to be placed on a separate, adjustable surface. The keyboard holder should be long enough to accommodate both the keyboard as well as a pointing device or mouse pad. It is important that both the keyboard and the keyboard holder be kept as flat as possible as this places the wrist in a more neutral position, minimizing muscle strain.

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Adjust the height of the keyboard to allow your shoulders and upper arms to be relaxed.

Also, the upper arm should be close to vertical and the lower arm horizontal – and the wrist should be straight.

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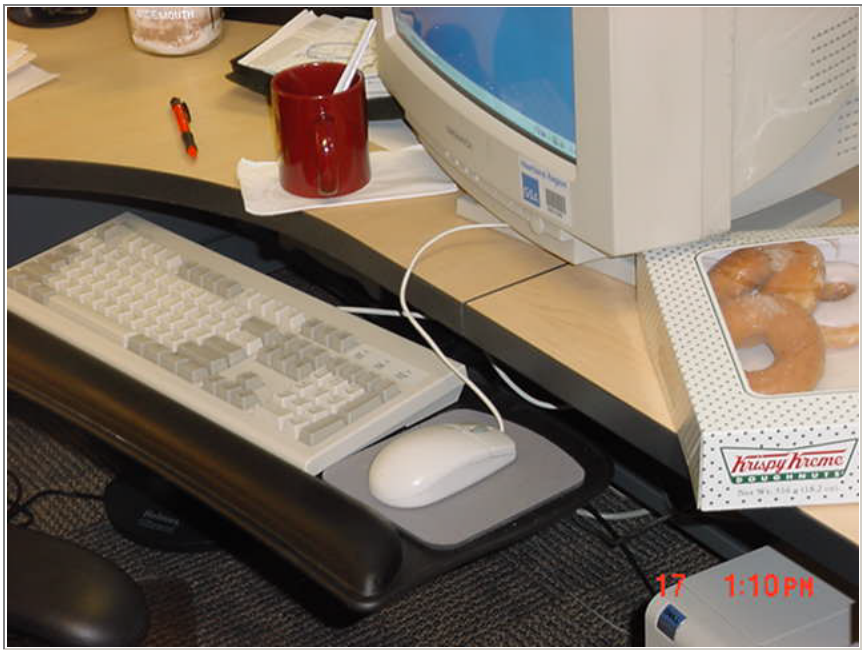
| The mouse and keyboard should be side-by-side, at the same level.<br><br>*(P.S. The Krispy Kremes are optional)* |  |

## Pointing Devices

The main pointing device used for computer work is the mouse. Shoulder, forearm, and wrist discomfort can be significantly reduced if the mouse is used optimally. Tips on proper usage of a mouse include:

- Place mouse at the side of the keyboard and at the same level; you should not have to reach for it.
- Use the armrest on the chair or rest your arm on another available support while using the mouse.
- Reduce pressure on the wrist from the work surface; a mouse pad or rest may help.
- Rest your finger on the button, do not hold it hovering above the mouse.
- Keep the wrist straight; wrist angle should not exceed 20 degrees when extended, nor be bent to either side.
- Do not grip the mouse tightly.
- Choose a mouse that fits your hand; many different sizes and shapes are available.
- Set your mouse speed at about the middle range.
- Reduce the time spent using the click and drag feature of the mouse as this puts strain on the forearm and hand. Software is available which will convert an extra mouse button to one which performs the click and drag function, or the double click function.

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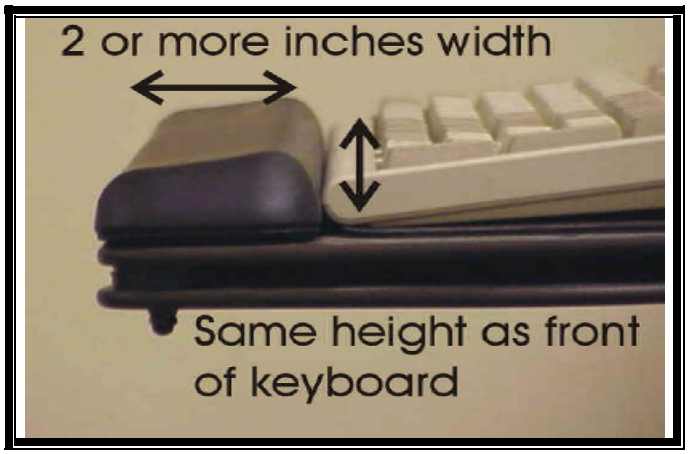
There are other pointing devices available, such as trackballs, gliding touch pads (activated by movements of the finger), and tablet pads (pen-like substitutes). However, your should recognize that the advantages and disadvantages of these various input devices have not been well studied, and should be experimented with before purchase.

## Wrist Support

The term "wrist rest" is actually a misnomer. We don't want to have anything in contact with the wrist itself while we are typing at a keyboard or controlling an input device, whether a mouse or a trackball. One of the worst things we can do is increase pressure on the wrist while we use our hands in this way. A more accurate term would be a "palm" rest, a point of view shared by increasing numbers of people involved in ergonomics.

The main intent of a palm rest is to prevent the hands from dropping off the edge of the keyboard while we type. Extension of the wrist (bending it back toward the body) has been shown to cause the greatest increase in pressure in the carpal tunnel. Also, just think of what the tendons of the wrist must do to turn the corner at the palm, and the irritation and friction created in the process.




## Copy Holder

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Copy holders are recommended for individuals who perform input tasks from a source document. Copy holders eliminate frequent neck movements caused from looking back and forth between screen and paper, as well as continuous refocusing of the eyes. To maximize the benefits of a copy holder, it should be at the same height as the monitor, and as close to the monitor as possible.

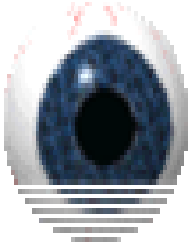
## Lighting

The recommended luminance at a VDT task area where data entry and retrieval is performed exclusively is 750 lux. Where data entry and retrieval is performed intermittently the recommended lighting level is 500 lux . These lighting levels can be adjusted for personal preference and may be augmented by task lighting.

Glare is the main lighting concern when working with VDTs. To help minimize glare:

- Position monitors parallel to overhead lights and perpendicular to the windows.
- Ensure wall color is neutral (not too bright).
- Remove or cover shiny surfaces and objects.
- Use blinds or curtains to minimize window glare.
- Install diffusers on overhead fluorescent lights.
- Use incandescent task lights over source documents.

## Vision



It is generally accepted that VDT use does not create vision problems or worsen existing vision problems. Constant VDT work, however, may contribute to eye fatigue. To reduce eye muscle fatigue frequently look away from the screen and focus on a distant object.

Contact lens wearers may experience dry eyes when working with a computer. The office environment tends to be drier than normal, and when looking at a monitor people tend to blink less. To reduce these drying effects consciously try to blink more frequently, or use non-medicated eye drops.

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**Symptoms of eyestrain may be:**

- Sore, tired, itchy, dry, or burning eyes
- Headaches
- Difficulty focusing between the VDT and source documents
- Blurred or double vision
- Color fringes / after images
- Increased sensitivity to light

## Electromagnetic Fields

It is recognized that computers, along with many other electrical and electronic devices in our homes and workplaces, emit electromagnetic fields. The health effects of exposure to electromagnetic radiation from sources such as computers are continually under scientific scrutiny. Click here for more information

## Work Practices

Ergonomic furniture, with proper adjustments, may reduce the risk of injury when working with a computer. The risk of injury however, is not entirely eliminated. Work practices can help reduce the risk even further.

This includes proper job design which, along with changes in job tasks, should include frequent changes of posture. It is important to stand up, move around, stretch, and get away from computing tasks during the work day. We recommend five minutes away from the computer every hour. By working with your supervisors and managers, it should be possible to design a job which incorporates various types of duties and eliminates continuous computer work.

You should now be able to go back up to the top of this page and find the ergonomic mistakes present. If this still looks like your workstation, you need to re-read this article.

## Take a Stretch/Exercise Break!

- Take a 15 minute break from the computer at least every two hours to get up and move around
- Rotate job tasks when possible to avoid constant keyboard work.
- Take a mini-break, as needed, to stretch your body or rest your eyes. Frequent short breaks are desirable if your work situation allows.
- Blink often to keep your eyes moist.
- Refocus your eyes by looking away from your screen and focusing on a distant object at least 20 feet away every 10 minutes or so.

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- Release tension in the neck by looking back over the shoulder while sitting up straight. Hold for 10 seconds, then slowly turn head and look back over shoulder and hold.
- Relax shoulders by rotating them backwards several times and then forwards.
- Spread your fingers as far apart as you can. Hold for 5 seconds. Then make a fist. Repeat several times.
- Keep moving throughout the day by taking mini-breaks for your favorite stretches.

## Summary

Below is a diagram that summarizes the basics of an ergonomically **correct** workstation.

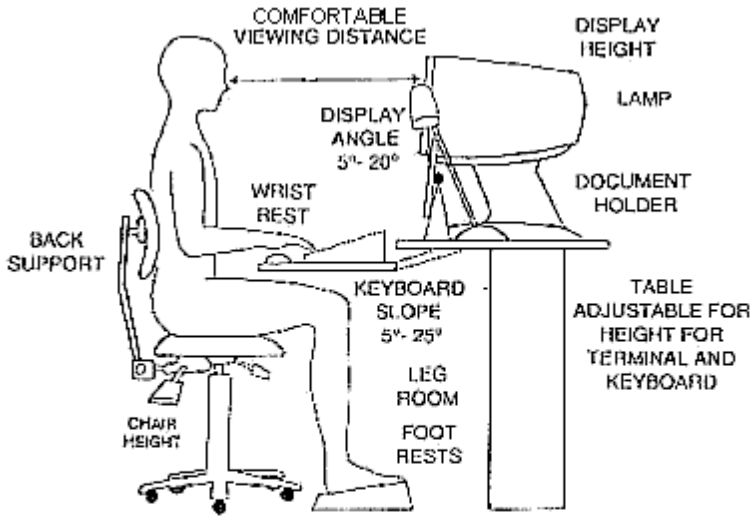


Diagram from "Ergonomics and VDT Use," flyer prepared by the Library of Congress Collections Services VDT Ergonomics Committee, 1991-92.

## More Information or Assistance

If you need more information regarding this subject, please contact us in the Regional Safety and Environmental Management Office.